

# Linear Relationship of Different Variables between University Entrance Exam Scores and Grade Point Averages of Technical Education Faculty Students

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## ABSTRACT

The objective of this study is to show the correlation between Student Selection and Placement Exam (OSYS) scores and Grade Point Averages (GPA) of students who registered in the Technical Education Faculty in 2005 and to what extent OSYS scores can predict success. It was examined whether or not a linear relationship between OSYS scores and the GPA of each academic year exists. Besides the factors including gender, type of secondary education school attended, and the regions of student origin were researched. In order to discover a qualitative reason for this, a survey was conducted asking students open-ended questions. From the end of the first year onwards, the predictive validity of OSYS scores shows a significant correlation close to zero. For other academic years, there has been no significant correlation observed. At the same time, the OSYS scores and degree GPA at graduation can scarcely be predicted.

**Keywords:** Student selection and placement exam, Predictive validity, Regression analysis, Academic success.

## INTRODUCTION

In Turkey, a university entry exam is conducted nationwide at the end of each academic year. High school graduates can apply to schools, faculties, and programs in accordance with the scores they receive from the exam. Exam results are categorized in different groups including quantitative, verbal, and equiponderant. After determining their level of preparedness according to the categorized test scores, prospective students forward their preferred choice of schools and fields of study to the University Selection and Student Placement Center (OSYM) and then the students are placed to programs according to their objective exam results.

Multiple choice exams consist objective test material in which the validity and reliability of exam questions are rather high and analyzed with a high correlation. Responses to the questions are evaluated conducting a change-mistake analysis. During the exam, attempts are made to measure the knowledge, ability, and even the competence of candidates in such a way as to extract their level of synthesis.

Predictive validity can be defined as test forecasting student success in the selected program prior to enrollment. The exam results show the candidate's readiness level and only those with high potential of success are admitted to the program. In these types of predictive validity studies, the correlation between the entry score and success score in the field of study is taken into consideration and this

correlation is found to be linear, benefiting from Pearson Moments Cross Correlation [1].

Linear correlation techniques are utilized to calculate the magnitude of the relationship between two variables [2]. Predictive validity shows its strength of prediction of success in advance [3]. Finding the predictive validity is a program assessment tool. Therefore, it can predict the program for which a student is ready. One of the program development dimensions is evaluation [4].

Kozan and Tezer, in 1979, point out that the exam scores of those who take the university entry exam are inadequate in conducting predictive validity, and following regression analyses of minimum test scores and GPAs, the multiple determination (prediction power) coefficient is found to be 0.01 and 0.31 [5].

In 1985, Aşkar analyzed the shape of the correlation between each exam score taken from the OSYS and subtests and grades taken from 1st year courses that are of similar nature to the courses taken in middle school using multiple regression analysis through polynomials [6]. He attempted to predict the first year GPA along with the OSYS test and subtests, benefiting from multiple regression analyses in order to determine the prediction link. It is stated that the second stage university entry exam predicted better than the first stage exam; however, it had a lower validity coefficient.

In another study, the author studied the relationship between academic success/GPA and OSS and OYS exam results of 242 students who graduated from the Faculty of Educational Sciences of Ankara University [7]. He discovered that no significant difference exists between the OSS-verbal results and the first academic year GPAs of the graduates according to their departments. There is also no significant correlation between quantitative and equiponderant results except for one field of study. There was no significant correlation found between OSS results and cumulative GPA again except for one field of study. The OYS social sciences test results and first year GPA correlation is between -0.32 and 0.13, the OYS literature-social test results and first year GPA correlation is between -0.38 and 0.16, the OYS literature-mathematics test results and first year GPA correlation is between -0.09 and 0.63. The OYS social sciences test results and cumulative GPA correlation depending on fields of study is between -0.17 and 0.38, the OYS literature-social test results and cumulative GPA correlation depending on fields of study is -0.28 and 0.32, OYS literature-mathematics test and cumulative GPA is 0.08 and 0.35.

In 2005, Violato and Donnon investigated the predictive validity of the Medical College Admission Test (MCAT) for clinical reasoning skills upon completion of medical school [8]. A total of 597 students (295 males, 49.4%; 302 females, 50.6%) participated from 1991 to 1999. Stepwise multiple regressions of the MCAT and premedical school GPA (independent variables) on the Part 1(declarative knowledge) and Part 2 (clinical reasoning) of the Medical Council of Canada Examinations (dependent variables) were employed. For Part 1, the multiple regression revealed that three predictors (verbal reasoning, biological sciences, GPA) accounted for 23.3% of the variance, and for Part 2, two predictors (verbal reasoning, GPA) accounted for 11.2%.

Meagher et al. studied for examining the validity of Pharmacy College Admission Test (PCAT) scores for predicting grade point averages (GPAs) of students in years 1-4 of pharmacy programs [9]. Data were collected from 11 colleges and schools of pharmacy: entering cumulative and math/science GPAs, PCAT scaled scores, pharmacy program GPAs for years 1-4, student status after 4 years. Correlation, regression, discriminant, and diagnostic accuracy

analyses were used to determine the validity of the PCAT for predicting subsequent GPAs. PCAT scaled scores and entering GPAs were positively correlated with subsequent GPAs. Regression analyses showed the predictive value of the PCAT scores, especially in combination with entering GPAs.

In the study of Basturk, he examined the predictor validity of the Civil Servant Selection Examination (KPSS) for Science and Technology pre-service teachers [10]. Specifically, This study explored the correlation between the pre-service Science and technology teachers' KPSS performance and their "cognitive ability" represented by Student Selection Examination (OSS) and their "quality of academic performance" represented by Undergraduate Grade Point Average (GPA). Pre-service teachers (N=189) were participated for this study from the Pamukkale University, Faculty of Education, Department of Science and Technology between 2004-2005 and 2005-2006 academic years. Pearson correlation and multiple regressions analysis were used to analyses the data. The results showed that there was no significant relationship between OSS and UNO but there is a significant relationship between GPA and KPSS performance and OSS and KPSS performance. However both relationships were low. Multiple regression equation showed that when two predictor variables combined and used, they explained 24 % of the variance in KPSS performance and both OSS and UNO were is statistically significant and valid predictor at .01 alpha level. As a result, both OSS and UNO were significant and valid predictor of KPSS performance.

The comprehensive research defined above indicates that there is a significant correlation between OSYS scores and GPA in some academic years. It seems that there is a moderate relationship between two-staged university exam results and some courses.

## MATERIALS AND METHOD

### *Definitions*

Prediction can be defined as a process of making futuristic forecasting of the unknown using statistical techniques and the known. The predictive validity of a test is the correlation between the scores received from the test and the direct measure for prediction of the variable and criteria obtained later [11].

Regression analysis is a statistical tool for the investigation and the modeling of relationships between a dependent variable and one or more independent variables.

### *Significance of the Research*

Considerable differences can be seen in readiness of students in mathematics and sciences because of qualifications they possess associated with the high school they come from.

This difference highly affects students' success in the aforementioned courses. Courses are combined with departmental courses and educational courses with teaching focus. During the course of the 4-year training process, students complete teaching internships and internships in firms and/or factories related to their profession.

Factors relating to students' personal qualifications and general circumstances (such as gender and region of origin), factors concerning high school graduated and circumstances surrounding the schools (high school graduated and its type), factors relating to students' interaction with other individuals and characteristics of the university (student-teacher interaction and satisfaction) are all factors that affect a student's success [12]. All of these factors have been queried in the interview.

Students of Technical Education Faculties only receive a diploma that allows them to become a vocational school teacher rather than an engineering or technical staff diploma even though the education they pursue is close to the one that is offered to engineering students. As a result, those who cannot be placed as a teacher are able to work as an untitled employee in firms or factories. This limitation affects students' motivation negatively during their education.

The objective of this study is to determine the predictive validity of OSYS points for students' GPA of 1., 2., 3. and 4. classes (degree GPA) and interpret the results by comparing and contrasting. In the study, the GPAs of the students were tried to predict considering the OSYS scores by using regression analysis and the correlation rates between obtained GPA and predicted GPA were examined. Finally, some evaluations about the factors that can be affected the academic success were performed referring the students' opinions.

The stated goal of the research is to answer the following question:

- Do entry exam scores to the Technical Education Faculty predict success during the 4 year education period depending on 1) gender, 2) whether students come from an academic high school or vocational school, or 3) whether they come from the Cukurova district where the university is located or elsewhere in Turkey?

In order to answer this question, answers to the following questions are sought:

1. What is the correlation between scores student scores on university entry exams and the GPAs during each academic year depending on whether;
  - a. they are male or female
  - b. they are academic high school graduates
  - c. they are vocational school graduates
  - d. they come from outside the Cukurova region
  - e. they come from the Cukurova region
2. Can scores of university entry exams predict students' degree GPA?
3. What are the students' opinions of the factors affecting their educational process?

In this study, it has been shown that, like the common hypothesis which appears in many other articles concerning the prediction validity of OSYM scores, these scores in fact cannot predict overall GPA. While testing this hypothesis, the tests were conducted taking a, b, c, d, and e sub factors into consideration.

### *Sampling*

The scope of this study encompasses all of the students who were registered during the 2005-2006 academic year. The sample of the study comprises the 2008-2009 graduates of Mersin University Technical Education Faculty (N= 141). Totally, 43% of the sample comes from vocational and technical high schools. The remainder is academic high school graduates.

### *Data analysis*

The quantitative findings required for this study are the GPAs for each academic year and degree GPAs of students registered in 2005-2006 and their corresponding 2005-2006 OSYS entrance scores to the Technical Education Faculty. Student scores sent by OSYS and each year's GPA were obtained from the student registrar's office.

A student's year end GPA is found by calculating the average of all the courses he has taken from the beginning of that year to the end. With this in mind, grades for each course are obtained by multiplying the grade letter belonging to that course and the credit hours of the course and the total is divided into credit total. Degree GPA is the total grade point

average obtained for all years of study at the end of the 4th year. In this study, the 4 point scale has been converted to a 100 point scale in order to obtain greater precision. The correlation coefficient between OSYS scores and GPAs has been calculated.

**Table 1.** Correlation between OSYS scores and GPAs

Years	Categories	N	R	CI 95%	p
2005	All	141	0.1676	0.002355 – 0.3239	<b>0.0470</b>
	Girls	42	-0.04244	-0.3420 – 0.2649	0.7896
	Boys	99	0.1901	-0.007571 – 0.3735	<b>0.0594</b>
	Academic Schools	78	0.06859	-0.1563 – 0.2867	0.5507
	Vocational Schools	63	0.3202	0.07864 – 0.5262	<b>0.0105</b>
	Cukurova Region	124	0.2014	0.02604 – 0.3648	<b>0.0249</b>
2006	Outside Region	17	-0.09727	-0.5521 – 0.4022	0.7103
	All	141	-0.01060	-0.1756 – 0.1550	0.9008
	Girls	42	-0.5391	-0.7243 – 0.2812	<b>0.0002</b>
	Boys	99	0.1526	-0.04619 – 0.3398	0.1315
	Academic Schools	78	-0.007024	-0.2292 – 0.2158	0.9513
	Vocational Schools	63	-0.01269	-0.2596 – 0.2358	0.9214
2007	Cukurova Region	124	0.01896	-0.1579 – 0.1946	0.8345
	Outside Region	17	-0.1992	-0.6204 – 0.3113	0.4435
	All	141	0.03092	-0.1351 – 0.1952	0.7159
	Girls	42	-0.1949	-0.4709 – 0.1159	0.2161
	Boys	99	0.06980	0.1294 – 0.2636	0.4924
	Academic Schools	78	0.1345	-0.09076 – 0.3467	0.2404
2008	Vocational Schools	63	-0.09916	-0.3386 – 0.1524	0.4394
	Cukurova Region	124	0.01254	-0.1641 – 0.1884	0.8900
	Outside Region	17	0.1495	-0.3568 – 0.5879	0.5668
	All	141	-0.05413	-0.2175 – 0.1122	0.5238
	Girls	42	0.03290	-0.2738 – 0.3335	0.8361
	Boys	99	-0.09757	-0.2894 – 0.1018	0.3367
2008	Academic Schools	78	-0.07843	-0.2958 – 0.1467	0.4949
	Vocational Schools	63	-0.01129	-0.2583 – 0.2371	0.9300
	Cukurova Region	124	-0.07708	-0.2500 – 0.1006	0.3948
	Outside Region	17	0.1865	-0.3232 – 0.6122	0.4736

**Table 2. Regression analysis of GPAs based on sub-factors as a function of OSYS scores**

Years	Sub-Factors	Variables	Unstandardized Points			
			B	SE	t	p
2005	All	Constant	60.0448	6.5200	9.2094	<.0001
		OSYS scores	0.0414	0.0207	2.0044	0.0470
		R = 0.1676 R <sup>2</sup> = 0.0281	F = 4.0176	(p<0.001)		
2005	Boys	Constant	252.8830	30.0324	8,4203	<0,0001
		OSYS scores	0.7915	0.4150	1,9073	0,0594
		R = 0.1903 R <sup>2</sup> = 0.0362	F = 3.6380	(p<0.001)		
2005	Vocational Schools	Constant	230,6861	31,9393	7,2227	<0,0001
		OSYS Scores	1,1503	0,4358	2,6395	0,0105
		R = 0.3202 R <sup>2</sup> = 0.1025	F = 6.9671	(p<0.001)		
2005	Cukurova Region	Constant	254,4128	25,8760	9,8320	<0,0001
		OSYS Scores	0,7992	0,3518	2,2715	0,0249
		R = 0.2015 R <sup>2</sup> = 0.0406	F = 5.1597	(p<0.001)		
2006	Girls	Constant	444,8035	30,3144	14,6730	<0,0001
		OSYS scores	-1,6847	0,4162	-4,0480	0,0002
		R = 0.5391 R <sup>2</sup> = 0.2906	F = 16.3893	(p<0.001)		

In addition, using surveys containing open ended questions, students were asked about their compatibility with other students of different backgrounds and their interest in the professions they may be involved with after graduation. Interpretation of the findings is supported by the responses to these questions. In this study, qualitative results of the student surveys are compared in order to explain the predictive validity found quantitatively. Because students of the technical education faculty are adults, methods used to teach adults (andragogy principles) are utilized while generating survey questions related to motivation. Information concerning sources of external motivation (good job, promotion, high salaries etc.) and internal pressures (job satisfaction, self respect, quality of life) was found [13].

- ✓ Internal motivation is affected by the learning atmosphere within the faculty: It is the equipment within the faculty, self respect gained in the educational environment and the quality of life in this environment.
- ✓ External motivation the other hand, are prospects for gainful employment, high

salaries, etc that students can achieve with education.

By first putting forward key words on these subjects some student opinions were collected. Later, in light of these opinions, open ended questions regarding internal and external motivation that affect student success, were generated. Academicians who instruct vocational courses were asked for their opinions about the questions to establish the content validity of the survey.

## RESULTS AND DISCUSSION

Following are the regression and correlation analysis concerning the secondary problems along with the qualitative research survey evaluation. The Student Selection and Placement Exam scores of different years, GPAs, along with other independent variables and prediction coefficient numbers are given in Table 1. According to the data in Table 1, it can be said that, on a yearly basis, there is no significant relationship between students' GPAs and their OSYS scores. In order to find out what lies behind this lack of correlation,

factors such as the gender of students, schools graduated from, and city of origin (Cukurova region or not) are examined, and yet it is observed that these factors have no impact.

The linear relationship between the OSYS scores and GPAs of 141 students who registered in 2005 were examined with a correlation coefficient, and a significant relationship being discovered. ( $r=0.1676$ ;  $p< 0.05$ ). The correlation coefficient number between the OSYS scores and GPAs of vocational school graduates indicates a significant relationship. ( $r=0.3202$ ;  $p<0.05$ ) The correlation coefficient number showing a linear correlation of those who come from outside the Cukurova district to study at the Technical Education Faculty indicates a significant relationship. ( $r=0.2014$ ;  $p<0.05$ ). There is a mid-level negative significant correlation between the OSYS scores and GPAs among female students in 2006. ( $r= -0.5391$ ;  $p<0.05$ ). The reason for this is the fact that engineering courses often become more intense during the sophomore year. No significant correlation is encountered with other variables in 2006. Variables for the 2007 and 2008 academic years show no significant relationship with OSYS scores.

According to the results given in Table 1, it is observed that there is a statistically significant correlation between students' OSYS scores and GPAs only for some sub-factors in years 2005 and 2006. On the contrary, no significant correlation exists between OSYS scores with neither third year GPAs nor degree GPAs. Considering this, it can be stated that OSYS scores have an effect on first and second year GPAs, but it is not possible to predict the third year and degree GPAs by using the OSYS scores of a student. The first year GPAs of students who came from the cukurova region and students who graduated from vocational schools can be predicted using OSYS scores.

In 2005, the significance of OSYS scores for boys' first year GPA considerably exceeds the 0.05 level and as a result the sub-factor has been added into the regression analysis. If the sample size increases, the value could become significant. In 2006, the only statistically significant correlation exists between girls' GPAs and OSYS scores.

In Table 2, regression equations for the GPAs that have a positive correlation with OSYS scores under given sub-factors were presented.

The t-score for the independent variable OSYS scores based on all sub-factors was calculated to be 2.0044 ( $p<0.001$ ) in 2005. The F value determining GPA of first year was calculated to be 4.0176 ( $p<0.001$ ). The t value for the variable, OSYS score of the boys was 1.9073 ( $p<0.001$ ). OSYS scores can explain 3.8% of the variability upon success of the students at the end of the first year. The rate is 3.6% for the boys.

The effects of OSYS score based on the school type and the region type upon first year GPA were revealed in an F value of 6.9671 ( $p<0.001$ ) 5.1597, respectively. 10.25% of the variability upon the GPAs of the students graduated from vocational schools with OSYS scores was accounted for. This rate is roughly 4.1% for the GPAs of the students from cukurova region.

In 2006, the t-score for the independent variable, OSYS scores of girls was found to be 4.0480 ( $p<0.001$ ). The OSYS score was found to determine second year success of the girls with an F value of 16.3893 ( $p<0.001$ ). 29.1% of the variability between the second year GPAs of the girls and their OSYS scores has been accounted for.

According to the regression analysis results, OSYS scores can predict both the first and sophomore year GPAs only on the basis of some of the sub-factors. However, it cannot explain the 3rd and final year scores. Similar results have been compared and contrasted in studies conducted at different times. The first study was conducted in 1979 by Kozan and Tezer on the topic of university selection scores' not being able to predict success in higher education programs [5]. Their study concluded that the prediction validity was insignificant remaining between 0.01 and 0.31. On the other hand, Erdođdu encountered a mid-level relationship varying between -0.09 and 0.63 among Turkish and Mathematics scores in OSS and OYS in the 1996-1997 academic year and first year GPA [7].

When holistically examining the overall academic success of students on the basis of sub-groups (academic success in 2008 overall academic GPA) along with the correlation between OSS scores indicated in Table 1, it is found that this coefficient is not statistically significant. For this reason, it is not possible to model using a prediction equation between OSYS scores and overall academic success. As a result, it can be said that OSYS scores cannot predict overall success. According to this, the

various researches being published on this subject since 1979 as well as the hypothesis presented in this study have been tested and validated.

In addition to regression and correlation analysis, motivations of the students were examined by using a survey in order to interpret other factors on the academic success.

Responses to the survey questions are grouped as follows:

- ✓ Student responses regarding internal motivation are as follows: "Motivation is negatively affected because: 1) lectures are conducted by lecturers rather than associate professors or professors, 2) lecturers conduct classes on the basis of memorization, and 3) there is a lack of social activity areas within the faculty." Motivation is affected negatively as students considered their education insufficient due to a lack of practice based training for the private sector." "The quality of academic life and trust in the classroom were affected negatively because some vocational school graduates failed quantitative courses while the remaining students, from different high schools, were successful.
- ✓ Student responses regarding external motivation are as follows: "In departments with more job opportunities, desire to learn the profession is often high." Motivation is affected negatively due to a perception of: 1) not being able to find job other than teaching, 2) working only as a temporary worker with no title, and 3) not being employed at factories independently as graduates of a Technical Education Faculty."

The idea of internal and external motivation often being affected negatively is common.

## CONCLUSION

From the end of the first year onwards, the predictive validity of OSYS scores shows a significant correlation close to zero. For other academic years, there has been no significant correlation observed. At the same time, the OSYS scores and degree GPA at graduation can scarcely be predicted. One of the reasons has been seen as motivation. Even though students are placed within a department according to their scores, due to the coefficient number regulation that encourages students to work in vocational schools as teachers, students with different backgrounds and different

levels of preparedness have come together in the same educational environment. Motivation is negatively affected as a result of the fact that students are assigned as teachers only after graduation, with their chance of assignment standing at only 3.8% nationwide, leaving them few other viable options other than working as a temporary worker without a title.

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